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6. AUTHOR(S)

Benjamin Chu

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES)

Chemistry Department
State Univeristy of New Yrok
Stony Brook, NY 11794-3400

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13. ABSTRACT *(Maximum 200 words)*

Fruitful results were achieved by investigating the structure and dynamics of self-assembled diblock and triblock copolymers by means of a combination of physical techniques, including static and dynamic light scattering, small angle x-ray scattering, small angle neutron scattering and atomic force microscopy. The polymer colloids are able to form core-shell micelles in a closed association process, as well as flower-like and more open-structured aggregates, depending on the molecular architecture, composition and solvent selectivity of the block. A detailed study on even a few selected samples of Pluronic polyols consisting of EPE type triblock copolymers in aqueous solution has resulted in the development of a new separation medium for DNA capillary electrophoresis where E and P are, respectively, oxyethylene and oxypropylene. By taking advantage of our knowledge on colloid physics, narrow size distribution polymeric microspheres with superparamagnetic magnetite cores are being developed. The polymeric shells contain active sites which can be modified chemically, making the microspheres possible candidates as drug delivery or magnetic resonance imaging agents. Finally, we have developed a centrifuge ball viscometer capable of measuring the viscosity of polymer melts, including that of poly(tetrafluoroethylene) (also known as Teflon).

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Structures and Dynamics of Self-Assembled Organized Functional Polymers in Solution

Final Report

April 27, 1998

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Contract # DAAH04-94-G-0053

Chemistry Department
State University of New York at Stony Brook

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FINAL REPORT

A. Statement of the Problem Studied

Investigate the structure and dynamics of block copolymers in selective solvents, including self-assembly behavior and the formation of gel-like structures at high polymer concentrations.

B. Summary of the Most Important Results

Based on fundamental knowledge gained from the project, (i) a new visocosity-adjustable and surface active separation medium has been developed for DNA capillary electrophoresis in 1xTBE buffer, and (ii) viscosity characterization of poly(terafluoroethylene) using a centrifugal ball viscometer.

C. List of All Publications:

1994. 1. Qicong Ying, James Marecek and Benjamin Chu, "Solution Behavior of Buckminsterfullerene (C_{60}) in Benzene," *J. Chem. Phys.*, **101**, 2665 (1994).

2. Zukang Zhou, Benjamin Chu and Dennis G. Peiffer, "Chain Architecture and Self-Assembly of Block Copolymers in Solution," *J. Polym. Sci., Polym. Phys.*, Rapid Communication, **32**, 2135 (1994).

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4. Kung Linliu, Fengji Yeh, Jeffrey W. Shook, William H. Tuminello and Benjamin Chu, "Development of a Centrifuge Ball Viscometer for Polymer Melts," *Rev. Sci. Instrum.*, **65**, 3823 (1994).

5. Guangwei Wu, Benjamin Chu and Dieter K. Schneider, "Small-Angle Neutron Scattering Study of Polymeric Micellar Structures," *J. Phys. Chem.*, **98**, 12018 (1994).

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11. Zukang Zhou, Benjamin Chu and Dennis G. Peiffer, "Association Characteristics of Copolymer Micelles in a Solvent Selective for the Middle Block," *Langmuir*, **11**, 1956 (1995).

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13. Li-Zhi Liu, Fengji Yeh and Benjamin Chu, "Synchrotron SAXS Study of Crystallization and Microphase Separation in Compatible Mixtures of Tetrahydrofuran-Methyl Methacrylate Diblock Copolymer and Polytetrahydrofuran," *Macromolecules*, **29**, 5336 (1996).

14. Guangwei Wu, Lizhi Liu, Vinh-Bao Buu, Benjamin Chu and Dieter K. Schneider, "SANS and SAXS Studies of Pluronic L64 in Concentrated Solution," *Physica A*, **231**, 73 (1996).

15. Zukang Zhou, Yung-Wei Yang, Colin Booth and Benjamin Chu, "Association of a Triblock Ethylene Oxide (E) and Butylene Oxide (B) Copolymer ($B_{12}E_{260}B_{12}$) in Aqueous Solution, *Macromolecules*, **29**, 8357 (1996).

16. Eugene L. Sokolov, Fengji Yeh, Alexei Khokhlov and Benjamin Chu, "Nano-Scale Supramolecular Ordering in Gel-Surfactant Complexes: Sodium Alkyl Sulfates in Poly (Diallyldimethylammonium) Chloride," *Langmuir*, **12,** 6229 (1996).

1997. 17. I. A. Nyrkova, A. N. Semenov, A. R. Khokhlov, K. Linliu and B. Chu, "Motion of a Probe Ball in the Fluid Under Centrifugal Acceleration," *J. Phys. II France,* **7**, 1709 (1997).

1998. 18. Tianbo Liu, Zukang Zhou, Chunhung Wu, Vaughn M. Nace and Benjamin Chu, "Dominant Factors on the Micellization of $B_nE_mB_n$-Type Triblock Copolymers in Aqueous Solution," *J. Phys. Chem. B*, **102,** 2875 (1998).

19. Fengji Yeh, Eugene L. Sokolov, Thomas Walter and Benjamin Chu, "Structure Studies of Poly(diallylmethylammonium chloride) Gels and Its Surfactant

Complex," *Langmuir*, submitted for publication.

Inventions

1. Benjamin Chu and Chunhung Wu, "A New Separation Medium for Capillary Electrophoresis"; new patent application filed on September 4, 1996, Research Foundation Reference: R-7142. Docket: 178-215.

2. Benjamin Chu, Pierre Dresco and Vladimir Zaitsev, "Controlled Size Polymeric Microspheres with Superparamegnetic Cores"; patent is being filed, Research Foundation Reference: R-7215. Docket: 178-230.

Scientific Personnel

Prof. Ben Chu	-	Principal Investigator (1 month -summer)
Mr. James Hanke	-	Graduate Student (M.S., 19
Mr. Pierre Dresco	-	Graduate Student (M.S., 19
Mr. Jean Rousseau	-	Graduate Student (Ph.D.,
Mr. Paul Harney	-	Graduate Student (Ph.D.
Dr. Zukang Zhou	-	Sr. Research Scientist (50%)
Ms. Jane Wainio	-	Project Staff Assistant (20%)